

REMARKS**Status of the Claims**

Claims 1-62 are pending in the present Office Action, with claims 47-62 being in a withdrawn status. Claims 1-4, 11, 12, 22, 26-29, 32, 33, 39 and 46 are herein amended. Claims 25, 30, 31, 34, 35, and 47-62 are canceled without prejudice. Reconsideration of pending claims 1-24, 26-29, 32, 33, and 36-46 is respectfully requested. Furthermore, new claims 63 and 64 are presented for examination in the pending application. Support for the amendments and new claims can be found throughout the specification and claims as originally filed, and as detailed below. No new matter has been added.

Applicants note that the Office Action lists claim 32 as being allowable subject matter in some portions but rejects the claim as being anticipated by the prior art in another section. In addition, claims 9 and 42 are listed as having all its elements taught by the cited reference in one section (see 102 rejection of the Office Action), and being obvious in light of the same art, though the art does not explicitly teach all the elements of the claims in another section (see 102/103 rejection for claim 42 and 103 rejection for claim 9). For the purposes of this response, claim 32 is considered allowable subject matter. If claim 32 is considered rejected, Applicants respectfully request clarification of this rejection. In light of the amendments and remarks herein, claims 9 and 42 are allowable regardless of the specific basis of their respective rejections.

Restriction Requirement

Applicant herein affirms the previous telephone election made to prosecute claims 1-46 with traverse. Non-elected claims 47-62 are presently canceled to expedite allowance.

Allowable Subject Matter

Applicants acknowledge with appreciation the Examiner's allowance of claims 2-4, 11, 12, 27, 32-35, 39 and 46. To expedite allowance of these claims, amendments are requested to claims 2, 4, 11, 12, 27, 28, 32, 39, and 46 to include the recitations of former claim 1, from which each of these claims directly depend. Furthermore, claim 3 is amended to depend from

allowable amended claim 4. Claim 28 is amended to recite that “the step of depositing a material further comprises filling the open spaces with the material, the material including at least one of a silicate, a metal, and a ceramic”. Thus, amended claim 28 combines the patentable subject matter of claims 28, 30, and 31. Claim 33 is amended to recite that “the step of inducing decomposition of the porogens further comprises at least one of pyrolysis, irradiation, and curing the material.” Thus, amended claim 33 combines the patentable subject matter of former claims 33, 34, and 35. Accordingly, claims 30, 31, 34, and 35 are canceled.

Rejections Under 35 U.S.C. §112

Claims 22, 25, 26, 28, 30, 31, and 38 stand rejected under 35 U.S.C. §112. In light of the amendments to the claims, and the following remarks, all pending claims conform with the requirements of 35 U.S.C. §112.

Applicants’ amend claim 22 to recite that “the step of depositing a material further comprises filling the open spaces with a composition that is a liquid at room temperature and atmospheric pressure.” Support for this amendment is found in the application at page 13, lines 1-5 (noting that tetraethylorthosilicate (TEOS) can be used as a filling material, TEOS having a boiling point of 160°C at atmospheric pressure). In light of the amendment to claim 22, the rejections under 35 U.S.C. §112 are rendered moot.

To expedite allowance of the present application, Applicants cancel claim 25 without prejudice, reserving the right to prosecute the claim in a related continuing application. Accordingly, the indefiniteness rejection of this claim is rendered moot.

Claim 26 is amended to recite that the step of depositing a material further comprises “generating an uncharged species.” Support for the amendment is found in the application from page 15, line 30 – page 16, line 1 (stating that “[n]eutral rather than charged species are favored”). As amended, claim 26 does not contain the term “neutral,” thus obviating the indefiniteness rejection.

As discussed above, claim 28 is amended to recite that “the step of depositing a material further comprises filling the open spaces with the material, the material including at least one of a silicate, a metal, and a ceramic.” As such, claim 28 is clear, definite, and abides by the

requirements of 35 U.S.C. §112, second paragraph. Claims 30 and 31, including patentable subject matter that is incorporated into claim 28, are canceled, obviating their respective indefiniteness rejections.

Current claim 38 recites that “the method further comprises selecting a porogen with a decomposition temperature above that needed to cure the material.” As such, the claim is definite under 35 U.S.C. §112, second paragraph. Though claims 38 and 1 (from which claim 38 depends) do not require a curing step, such a step is not necessary to define claim 38. For example, if a temperature of T_0 is needed to cure a material and the decomposition temperature of a porogen is T_1 , where T_1 is below T_0 , then claim 38 would not encompass a method using that material and that porogen. Whether or not a curing step is performed is irrelevant. Thus, claim 38 is definite.

In light of the amendments and remarks discussed above, all pending claims meet the requirements of 35 U.S.C. §112.

Prior Art Rejections

Anticipation

Claims 1, 8, 9 10, 13-16, 18-21, 23, 24 and 29 are currently rejected under 35 U.S.C. §102(a or e) as being anticipated by PCT Patent Application Number PCT/CA01/00621 (WO 01/86038). Furthermore, claims 26, 36, 38, and 40-45 are rejected under 35 U.S.C. §102 and 103; and claims 5-7, 9, and 37 are rejected under 35 U.S.C. §103(a), as being anticipated and/or obvious in light of WO 01/86038. The claims are patentable, however, because each claim now includes the step of “inducing *thermal* decomposition of the porogens,” which is neither taught nor suggested by the cited art.

Amended claim 1 is directed to a method of fabricating a nanoporous structure. The method includes the step of depositing an array of porogens on a substrate. The porogens are also crystallized such that they are densely packed. A material is deposited from the vapor phase to fill open spaces between the porogens. Thermal decomposition of the porogens is also induced. Support for the amended step of “inducing *thermal* decomposition” is found on page 7, lines 29-31 (noting that a porogen can decompose upon heating to the porogen’s decomposition

temperature), and on page 20, lines 15-16 (stating that Example 3 demonstrates the use of a thermal treatment to remove porogens).

WO 01/86038 does not teach or suggest the method of claim 1. WO 01/86038 is drawn to germanium-based photonic bandgap materials, and methods of producing such. In particular, the disclosed methods rely on forming a germanium based matrix on a silica based template. As such, chemical etching is the only technique mentioned in the reference to remove the silica based template, i.e., the porogen. For example, the reference teaches the production of a silica opal template that is embedded with a GeO_2 matrix. In contradistinction to the thermal decomposition step of claim 1, the silica opal is “*chemically etched* in a 1 wt% hydrofluoric acid in water solution” (see WO 01/86038 at page 18, lines 22-24, emphasis added) to remove the SiO_2 spheres. Though the reference also mentions the potential use of non-silica materials, such materials merely act as a frame for the subsequent formation of a silicon template (see WO 01/86038, page 24, lines 11-28); the resulting silicon template acting as the porogens into which the germanium-based matrix is filled. Again, there is no mention or suggestion of using *thermal* decomposition to remove the silicon porogen. Indeed, *thermal* decomposition of a silicon-based template in a germanium or germanium oxide matrix would ruin the matrix since silica and silicon have a substantially higher melting point than the germanium-based compounds. Thus, in no way can WO 01/86038 teach or even suggest the method of claim 1.

Since claims 8, 9 10, 13-16, 18-21, 23, 24, 29 and 42 all depend from claim 1, they are all not anticipated by WO 01/86038 for substantially the same reason, among others. For example, claim 20 recites that the step of depositing a material comprises utilizing pulsed plasma chemical vapor deposition. WO 01/86038, however, provides no mention or suggestion of using pulsed plasma chemical vapor deposition. Claim 29 is amended to depend from claim 28 to provide sufficient antecedent basis for the claim. As such, the claim is patentable for the same reasons that claim 28 was allowed by the Examiner. Claim 42 recites that the material that is deposited is selected from the group consisting of metals, ceramics, OSGs, aluminum oxides, silicon dioxides, cerium oxides, calcium hydroxyapatites, silicons, silicon carbides, and gallium arsenides. WO 01/86038, however, provides no mention or suggestion of using any of these as a material for filling the open spaces between porogens. Though the reference discusses the use of silicon dioxide, such is only used as a template, not as a filling material. As well, use of silicon

dioxide would go against the teachings of the reference since the resulting structure would make a bad photonic bandage material with a low k dielectric constant. In light of these remarks and amendments, claims 1, 8, 9 10, 13-16, 18-21, 23, 24, 29, 32 and 42 are all patentable over the cited art.

Inherency

Claims 25, 26, 36, 38, and 40-45 are rejected under 35 U.S.C. §102 and 103 in light of WO 01/86038. As noted above, claim 25 has been canceled in response to the indefiniteness rejection. Since all of the remaining claims, which have been rejected on inherency grounds, depend from claim 1, they are allowable for at least the same reasons that claim 1 is allowable. For example, with regard to claim 36, the claim now incorporates the step of thermal decomposition from claim 1, in contradistinction to WO 01/86038, which explicitly relies upon acid etching.

If the rejection based on inherency is maintained, Applicants respectfully request that the Examiner provide facts and/or technical reasoning to show that WO 01/86038 inherently discloses the claimed subject matter of claims 26, 38, and 40-45. As stated in the MPEP §2112,

“[i]n relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art.”

Though the office action notes that it is reasonably believed that the disclosed structures inherently exhibit the properties corresponding to the properties claimed in claims 26, 38, and 40-45, such a lone statement does not provide the facts or technical reasoning necessary to establish a prima facie case of inherency. The burden of proof, accordingly, remains with the Examiner until the prima facie case is established. Applicants also specifically note that the teachings of claims 40 and 41 are in opposition to what is disclosed in WO 01/86038. Since the reference is specifically drawn to creating germanium-based photonic bandgap materials, the structures disclosed necessarily have very high dielectric constants. For example, the reference specifically states:

“These results show the optical quality of a structure made of fcc ordered micrometer cavities in a germanium matrix. It presents the *highest dielectric contrast* ($\epsilon_{\text{Ge}} / \epsilon_{\text{air}} = 16$) ever achieved in an electronically transparent material in the NIR region” (WO 01/86038, page 21, lines 3-6). (Emphasis added.)

In complete contrast, claims 40 and 41 are drawn toward nanoporous structures having a dielectric constant less than 2.7, or less than 2.0, respectively. Indeed, the reference teaches making materials having the exact opposite properties recited in claims 40 and 41.

For all these reasons and others, claims 25, 26, 36, 38, and 40-45 are patentable over WO 01/86038.

Obviousness

Claims 5-7, 9 and 37 stand rejected under 35 U.S.C. §103 (a) as being unpatentable over WO 01/86038. Since the claims all depend from amended claim 1, they are not obvious since the reference fails to teach the step of *thermal* decomposition, as discussed earlier. For at least this reason, the claims are allowable over the cited art. Accordingly, the Examiner is respectfully requested to withdrawn the claim rejections.

New Claims 63 and 64

New claims 63 and 64 are presented for prosecution. Claim 63, dependent from claim 1, recites that the material has a higher melting temperature than the porogen. Support for this claim is found in Example 4 of the application (page 28), discussing the thermal decomposition of polystyrene in a nanoporous OSG film; clearly the melting point of the polystyrene is lower than the melting point of the OSG or this process could not form the porous material. Claim 64, also dependent from claim 1, recites that the nanoporous structure has a dielectric constant less than bulk silicon dioxide. Support for this claim is found on page 1 of the application (noting the silicon dioxide has a dielectric constant of about 4.0), and at page 4, lines 25-29 (noting that the dielectric constant of the resultant porous film can be controlled by the porosity of the material). These claims are allowable for at least the same reasons that claim 1 is allowable. Their entry into prosecution is respectfully requested.

CONCLUSION

In view of the remarks above, Applicants submit that claims 1-24, 26-29, 32, 33, 36-46, 63, and 64 are in condition for allowance, and allowance thereof is respectfully requested. Applicants encourage the Examiner to telephone the undersigned in the event that such communication might expedite prosecution of this matter.

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Respectfully submitted,

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